# THE SIGNIFICANCE OF CUMULATIVE CORIOLIS ACCELERATION FOR TESTS FOR EXPERT MEDICAL SELECTION

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Translation of: "K Voprosy ob Ekspertnoy Znachimosti Proby na Kumulyatsiyu Uskoreniya Koriolisa," Vestnik Otorinolaringologii, Number 1, January-February 1974, pp. 25-28



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16. Abstract

The authors discuss the results of application of the test for cumulation of coriolis accelerations in 376 men: 269 healthy and 107 — with various somatic pathology. Action tolerance was assessed by the data of clinical observations, ECG, arterial pressure after Korotkov, results of neuropathologist's examination and EEG. The test was tolerated excellently in 15, well — in 14, satisfactorily — in 20, and poorly om 51% of cases. This test not only characterized vestibular stability, but also aided in detection of latent pathology: hypertensive reactions were revealed in 69 patients, hypertensive disease — in 19, epilepsy undiagnosed before was revealed in 7 patients.

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# THE SIGNIFICANCE OF CUMULATIVE CORIOLIS ACCELERATION FOR TESTS FOR EXPERT MEDICAL SELECTION

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Methods of the cumulative effect of coriolis accelerations in different /25* modifications are used quite widely today in aviation-space medical expertise (I. I. Bryanov, 1963; S. S. Markaryan, 1963; A. Ye. Kurashvili, 1967). Adopting these tests in specialized medical practice has pathogenic foundation, since the vestibular tests used in the clinic (cupulometry, the Barany tests, the caloric test) cannot create adequately strong stimulation permitting one to reveal the so-called latent forms of vestibulo-vegetative instability. As the result of a comparative evaluation of vestibular stability carried out by methods of flight-physician expertise and cupulometry (V. P. Baranova et al., 1967), the expert medical significance of tests for the cumulation of coriolis accelerations as the most informative test, in comparison with other vestibulometric methods, has been established. In the practice of flight-medical expertise, certain vestibular tests (the otolith reaction, swinging on Khilov swings) are employed several times for revealing such latent pathology of the central nervous system as epilepsy, the residual effects of cranio-cerebral injury, etc., (O. V. Solovey, 1938; G. G. Kulikovskiy, 1939, and others). Investigations on using the effects of coriolis accelerations for this purpose have been inadequately clarified. However, the application of a test for the cumulative effect of coriolis /26 accelerations, employed over a number of years, permitted us to assure ourselves the possibility of employing this investigation not only for characterizing vestibular resistance of the subject, but also for revealing latent pathological changes of certain organs and systems in practically healthy people. With this goal, the results of the effect of the test for the cumulative effect of coriolis accelerations were studied on 376 subjects.

All subjects underwent a combined clinical-physiological examination. Two hundred sixty-nine were pronounced healthy, and 107 were diagnosed to have somatic

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pathology: latent coronary deficiency (7 people), hypertensive disease of the first degree (22), mild symptoms of vegetative-vascular dysfunction (57), mild residual effects of cranio-cerebral injury (3), diseases of the liver and stomach (4) different forms of chronic tonsilitis (8) and vasomotor rhinitis (6).

Among the subjects were 372 men ranging in age from 21 to 40 and 4 ranging in age from 41 to 55. Cumulation of coriolis accelerations was accomplished by the intermittent method (after K. L. Khilov and I. I. Bryanov) and the continuous method (after S. S. Markaryan) of exposure using an electrical Barany chair with a standard angular acceleration of 180°. Exposure continued up to 15 minutes and the test was stopped at the appearance of pronounced (II--III degree) vegetative reactions (VR) with a sharp deterioration in the condition of the subjects. Before and after the test, as well as in the breaks between exposures, the pulse was counted on the ECG, arterial pressure was measured (after Korotkov), and the degree of expression of VR was estimated (after K. L. Khilov, 1936). Before and after exposure, the subjects were examined by a neuropathologist and if indicated, electroencephalography was carried out again. Tolerance levels in the tests were arbitrarily estimated according to a four value scale: excellent, good, satisfactory, and poor. With excellent tolerance, VR of the zero degree existed throughout the course of the entire examination; with good, VR of the first degree were not constant and appeared at individual stages of the test; with satisfactory resistance VR of the first degree were observed constantly. The appearance of VR second and third degree at any stage of the examination indicated poor tolerance to vestibular factors. The types of symptoms of motion sickness were determined using the classification of G. L. Komendantov (1969).

In analyzing the results of the investigation, it was established that 55 (15%) people tolerated the test with the evaluation excellent, 52 (14%) — good, 75 (20%) — satisfactory and 194 (51%) — poor.

In 109 (29%) people, the cardio-vascular form of motion sickness was revealed; this type of motion sickness was characterized by an initial increase in pulse frequency and an increase in arterial pressure within the limits of physiological fluctuations, with subsequent bradycardia (less frequently,

arrhythmia) and a decrease in blood pressure. In certain subjects, pain in the region of the heart appeared, as a rule, in cases of latent coronary deficiency. In 6 people of this group, typical vascular collapse developed with a sharp drop in arterial pressure to 65/35 mm Hg and loss of consciousness, which required the application of emergency treatment. In 68 subjects, hypertensive reactions were revealed (increase in maximum pressure to 150-190 mm Hg, minimum to 95-110 mm Hg). It should be noted that in 95 subjects of this group, the pressure indices in a state of rest did not exceed normal values. In 19 people of this group, the aftereffects were diagnosed as hypertensive disease. It is characteristic that in these subjects an increase in pressure remained within limits of a few hours following the test. The indices of arterial pressure in the remaining subjects, as a rule, return to the original level in the period of 5-30 min. The use of other vestibular effects (swinging on the Khilov swings, otolith reaction, etc.) was accompanied by an increase in arterial pressure in only 9 people of this group.

It is vital to emphasize that as a rule the hypertensive reactions were /27
noted when first conducting the test, and more seldom — when repeating the test. This was more frequently observed at the beginning of exposure and apparently was caused by the stress reaction. A stable increase in the indices of arterial pressure with multiple exposure (3-4 tests) was characteristic for persons with hypertensive disease. Hence, the test for cumulation of coriolis accelerations proved to be a unique functional load making it possible to reveal not only temporary hypertension in a number of subjects, but also hypertensive disease. Moreover, in 4 persons an increase in blood pressure when conducting a test was not recorded even though diagnosis of hypertensive disease and vegetative-vascular dysfunction of the hypertonic type was made.

The gastro-intestinal form of motion sickness, which was accompanied by a sensation of heaviness and discomfort in the region of the stomach, copious salivation, nausea and vomiting (of various degrees) was established in 44 (11.7 %) people. The connection of this form of motion sickness with the presence of pathology of the digestive tract was not established.

The neural form, which was characterized by dizziness, sense of heaviness in the head, headache, a sense of "numbness" and spasm in the fingers, etc., was

noted in 14 (3.7%) people. Vestibular load among persons with residual symptoms of cranio-cerebral injury was accompanied by more clear definition of the micro-symptoms of a limited central nervous system lesion (paresis of the facial nerves, pathological reflexes, etc.). In 7 persons with the neural form of motion sickness, in whom no pathological changes of the nervous system were revealed during the clinical and electroencephalographic investigation, at the 4th to the 6th minute of the test abortive epileptic seizures developed. The clinical picture of the observed disorders was expressed in limited convulsive manifestations of tonic character of certain groups of facial muscles (the lips) of the Khobotskiy reflex type with simultaneous tonic contraction of the muscles of the fingers. In addition to this, disorder of the speech functions with elements of motor aphasia, dysarthria, a short term state of disorientation, and pronounced vegetative disorders were noted. When investigating the bioelectrical activity of the cerebral cortex, bilaterial synchronous and stable paroxysmal activity was recorded in 4 persons of this group following cessation of the test; this indicated disorders in the deep structures of the brain.

On the basis of the neurological symptoms and data of the electroencephalogram which were revealed when conducting the test for cumulation of coriolis accelerations, a latently occurring pathology of the nervous system with the presence of epileptiform seizures (of the Jackson type) was diagnosed.

The application of other vestibular tests in these persons was not accompanied by the appearance of the above mentioned neurological symptoms in the process of the examination (otolith reaction, test on swings). Apparently, for the given persons the indicated functional loads proved to be inadequate for revealing well compensated pathology of the central nervous system. Moreover, the cumulative effect of coriolis accelerations detected the more vigorous functional reserves of the organism and made it possible to reveal the latent pathology.

The obtained results provide a basis to consider that cumulative effects of coriolis accelerations supplement the combination of vestibular tests for revealing latent pathology of the central nervous system, which are employed in the practice of otoneurologists, aural surgeons, and neuropathologists. Hence, the investigations conducted made it possible to emphasize the expert

significance of a test for cumulative coriolis accelerations for the purpose of revealing latent pathology of the organism. In our opinion, at the basis of the mechanisms leading to revealing the different pathological symptoms during exposure to coriolis accelerations lies disruption of activity of individual structures of the vestibular system, during which process different afferent stimuli which pass to the brain stem disrupt the normal functioning of the vegetative centers and symptoms of the organism.

When examining the pathways of possible irradiation of vestibular activity after exposure to coriolis accelerations (Graybiel, 1969), it is apparent that it either directly or indirectly encompasses practically all of the central structures of the brain. In this regard, the appearance of latent pathological processes upon activation of the vestibular analyzer is fundamental, as is the appearance of pathological processes of other systems upon which it exerts a modifying effect.

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